Producing a Successful Webcast

A Guide

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Section 1: Introduction

Given the appropriate tools, it is possible for small organizations to create and deploy content to multiple users simultaneously over the Internet via streaming video. This is a process called Internet broadcasting, otherwise known as *webcasting*.

This document will outline and diagram the general requirements for a live Internet broadcast and provide specific hardware and software profiles that can be used for a successful webcast. In addition, a glossary is provided to explain relevant terms.

Section 2: General Requirements

In order to perform a live webcast, you will need the following:

1. A webcam *or* a digital camcorder with integral Firewire connection[1]
2. A microphone to pick up any external audio for streaming[2]
3. A computer to which the camera will be attached; this computer will act as the source of the stream (see Section 4 for recommendations)
4. An Internet connection of sufficient bitrate to upload the streamed video
5. A subscription (free or otherwise) to a service capable of streaming live video and audio; examples include:
    a. Justin.tv
    b. Livestream
    c. uStream
    d. Wowza[3]
6. A web location (usually a channel or functional equivalent) at which viewers can access your streaming video; this is usually provided by the streaming video service
7. *Encoding software* that facilitates uploading the data stream to the desired service; some form of encoding software is usually provided by streaming video services

In addition to the above, a number of quality-of-life accessories can improve the broadcasting process:

1. A tripod on which to mount the webcam[4]
2. An external microphone for higher-quality audio pickup

[1] The integral Firewire is necessary to transfer data from the camera to the computer to which it is connected at rates fast enough to stream the video to the Internet; a USB or HDMI connection is not fast enough do this. Note: in order to connect a camera to a computer via Firewire, a *Firewire card* must be installed in the computer

[2] Most cameras have integral microphones, but these do not usually provide high-quality audio; an external microphone is recommended

[3] Wowza provides subscribers with access to a virtual computer in the Amazon Cloud that is configured to upload and distribute streaming video; a degree of expertise is required to configure the virtual computer properly for public access

[4] To interface with most tripods, the camera must be attached to a lug which is compatible with the tripod to which the camera will be attached

3. Multiple monitors, to facilitate streaming a view of applications and presentations on the source computer (whilst controlling the stream on another monitor) during the broadcast[5]
4. A pair of headphones (and an extension cord for the headphones) to prevent mic feedback
5. Sufficient lighting to illuminate the subject, if necessary

Section 3: Step-by-Step Instructions

In order to launch an Internet broadcast, perform the following steps:

1. Acquire the necessary components (computer, webcam, subscription, channel, encoding software, etc.); configure these components appropriately
    a. It is *strongly recommended* that you test these components prior to broadcasting to determine an optimal configuration
2. Establish a date and time for your live broadcast and inform likely viewers
3. Set up the camera; attach it to the source computer; establish a connection between the source computer and the Internet
    a. It is *strongly recommended* that a wired connection be used for this purpose; wireless Internet is generally too slow to accommodate streaming media
4. Use your encoding software to configure your web camera and the stream settings, including the following:
    a. The resolution and aspect ratio of the video stream
        i. The aspect ratio and resolution of the stream will depend on the capabilities of the camera and the capabilities of the streaming service you are using
        ii. The resolution for a typical Internet broadcast will be:
            1. 480x270, 640x360, or 1280x720 for widescreen aspect ratios
            2. 480x360, 640x480, or 800x600 for 4:3 aspect ratios
    b. The audio and video bitrate of the stream
        i. This decision will depend on the upload speed of your Internet connection, as well as the download speed of your likely audience
        ii. Typically, 150-500 kbits/second are considered optimal for video
        iii. 48-128 kbits/second are considered optimal for audio
    c. The frame rate of the stream
    d. The video codec used to encode/decode the stream
        i. H.264 is a common and reliable codec
    e. The audio devices that you wish to stream; this will vary depending on your setup
        i. If you have a subject who will be speaking into a microphone, you will probably want to specify that microphone input will be recorded by the stream
        ii. If you wish to include audio from the source computer (be it a pre-recorded audio file or an incoming Voice Over Internet Protocol (VOIP) call), then you will probably want to specify that speaker audio will be recorded by the stream
    f. The audio levels, in decibels, for each audio device recorded by the stream

[5] To do this, you will need encoding software that is capable of filming the desktop of your computer

        i. Optimal levels typically range from negative 12 (-12) decibels to zero decibels;
5. If there will be an active microphone (a “hot mic”) in the area during the broadcast, **turn off any unwanted audio sources, particularly any audio sources capable of reproducing the audio of the stream** (see Section 4 for more details)
6. Prepare any and all materials for the broadcast, including your subject
7. Begin the broadcast

A typical setup appears in Figure 1:

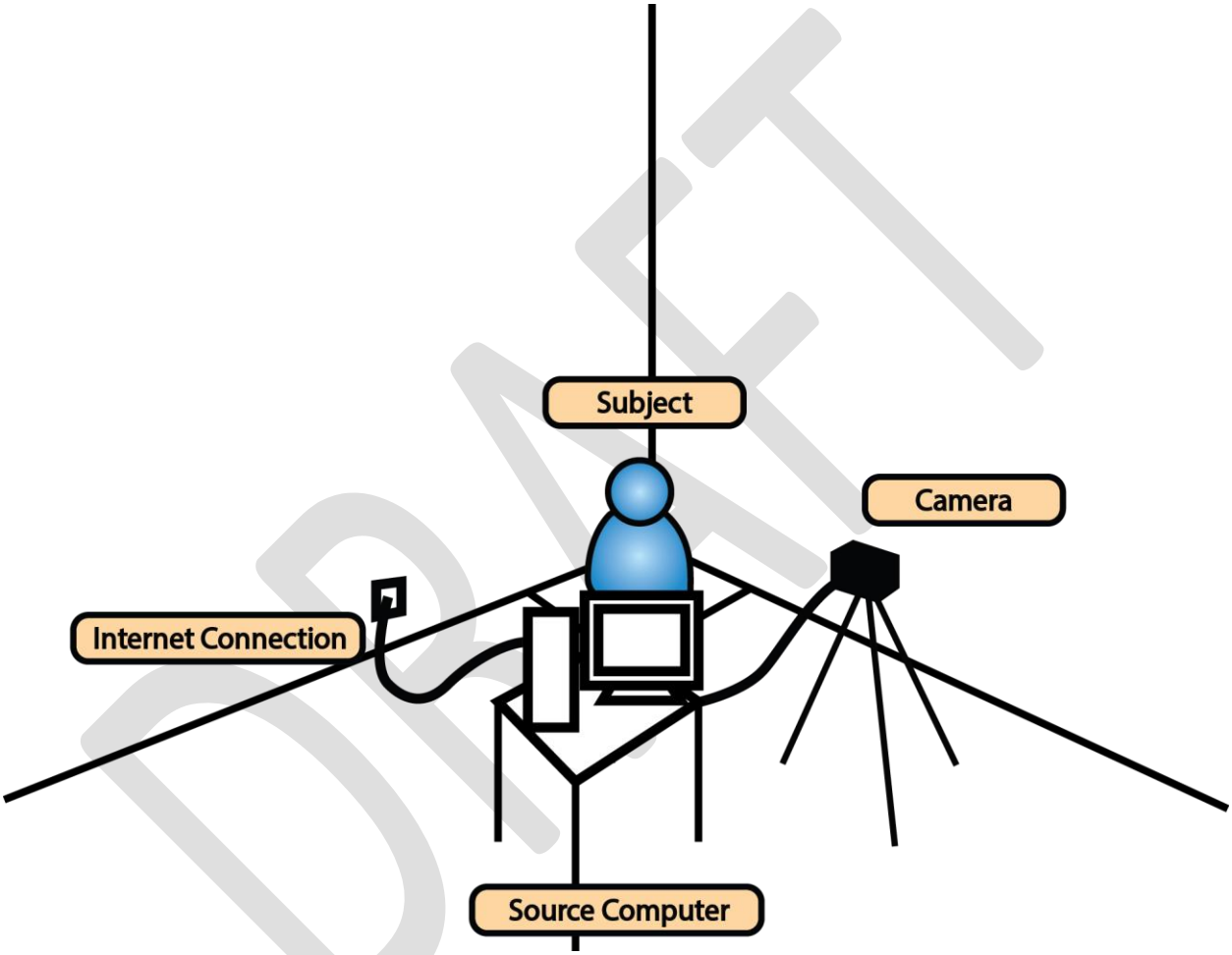

Figure 1: A setup in which the subject of the broadcast does not operate the source computer

Alternatively, the subject may also be the operator of the source computer, in which case the camera and any microphones present will point at the source computer operator.

Note that the setup in Figure 1 is extremely basic; additional microphones, light fixtures, and monitors can be used to augment the production.

Section 4: Best Practices

The following constitutes a list of procedures and settings that can be considered optimal for a live webcast.

Section 4.1: Equipment

- A webcam capable of recording footage at a bitrate of 500 kbit/s and a resolution of at least 640x360
- An Internet connection capable of uploading at a rate of at least 500 kbit/s
- A USB microphone
- Monitors:
    - If the subject of the broadcast is running the computer that acts as the source of the stream, two monitors are recommended:
        - Monitor 1: Contains broadcast controls
        - Monitor 2: Contains any materials to be displayed during the broadcast
    - If the subject of the broadcast is not *running* the source computer (see Figure 1), then three monitors are recommended:
        - Monitor 1: Contains broadcast controls
        - Monitor 2: Contains any materials to be displayed during the broadcast
        - Monitor 3: Provides the subject with a preview of the stream
- A computer that is compatible with the following specifications:
    - At least a quad-core processor; eight cores are recommended
    - At least six gigabytes of memory
    - At least four USB ports
        - Mouse
        - Keyboard
        - Web cam
        - USB microphone
    - A graphics card capable of supporting at least two monitors; if the subject of the broadcast is not running the source computer (Figure 1), then three monitors are recommended, requiring either:
        - a graphics card capable of supporting three monitors OR
        - a pair of graphics cards linked via nVidia Scalable Link Interface (SLI) or the equivalent
- A pair of headphones, to avoid an audio feedback loop generated by the combination of speakers and a hot mic (Figure 2)
    - If the subject of the broadcast is not running the source computer (Figure 1), a standard audio cable splitter is recommended to allow both the subject *and* the operator to listen in on the stream via headphones

Section 4.2: Procedures

- Minimize ambient noise:
    - Turn off cell phones, other computers, etc.

    - Make sure people in the vicinity of the broadcast move and speak quietly
- Use encoding software to record *only* input from the desired audio devices
- Avoid audio feedback (Figure 2):
    - Do not have speakers attached to the source computer anywhere near a hot mic
    - Advise anyone "calling in" to the broadcast to mute their own stream of the broadcast
    - Do not allow the stream to record audio from itself:
        - Instruct the encoding software to ignore audio devices that replicate the stream
- If the subject of the broadcast is not running the source computer, a silent, pre-established form of one-way communication between the source computer operator and the subject is recommended

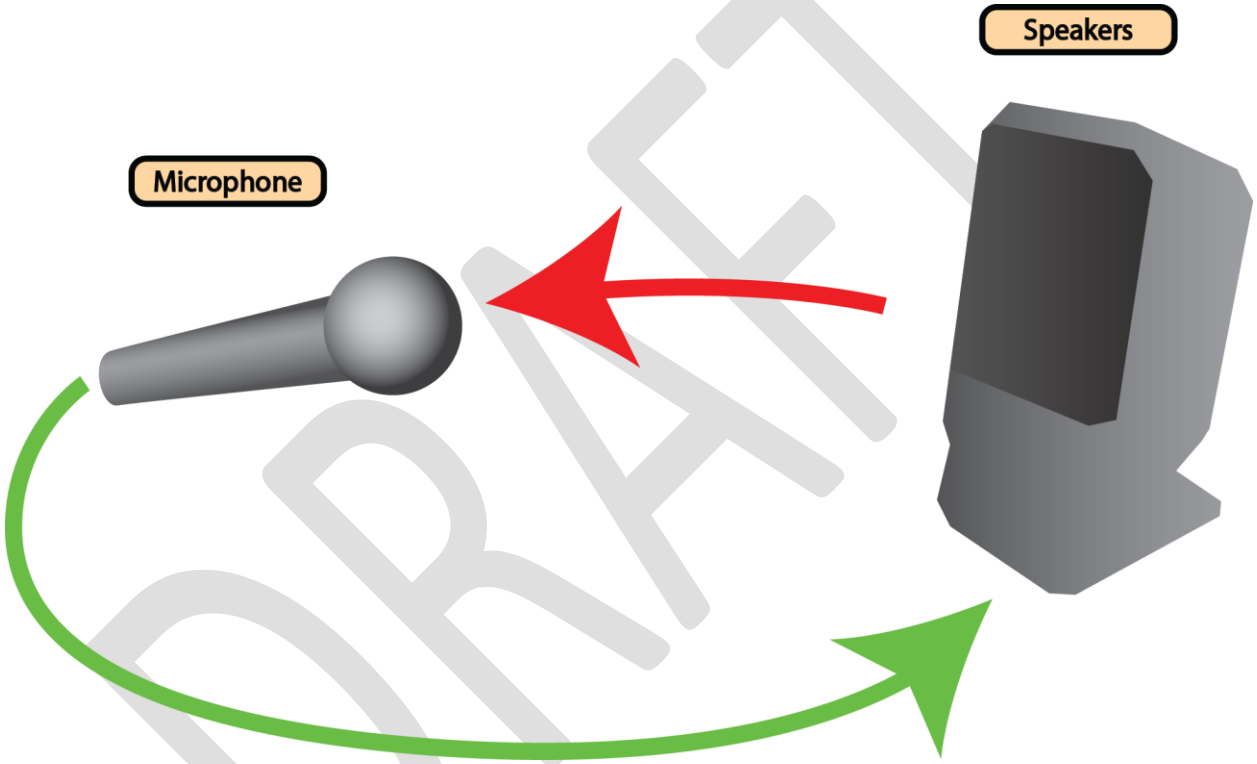

Figure 2: A classic audio feedback loop

Appendix A: Glossary

Appendix A.1: General Vocabulary

Bit Rate: The rate at which data is moved or displayed. Internet connections are measured by bitrate, as are digital audio and video files. For example: a 300 kilobits per second (kbit/s) Internet connection can move 300,000 bits of information per second. Note that Internet connection speeds are rated in terms of download speed *and* upload speed; often, low-cost commercial Internet services will provide a relatively high download speed for end users whilst restricting upload speed. Internet connections with both a high download speed *and* a high upload speed can be very expensive.

As indicated above, digital audio and video is also measured by bitrate; this indicates the rate at which the media file conveys information when it is played. In general: low-bitrate media convey less information and are therefore both smaller and provide lower-quality samples. Likewise: high-bitrate digital media tend to provide higher quality, but use more disk space. For reference:

- 64 kbit/s: a digital telephone audio signal
- 128 kbit/s: a digital audio file of average quality
- 1,400 kbit/s (1.4Mbit/s): an audio CD
- 3,500 kbit/s (3.5 Mbit/s): standard-definition television audiovisual signal
- 9,800 kbit/s (9.8 Mbit/s): DVD video
- 24,000 kbit/s (24 Mbit/s): an HD digital video camera
- 40,000 kbit/s (40 Mbit/s): A Blu-Ray disc

(Source: http://en.wikipedia.org/wiki/Bitrate#Multimedia)

Note that if you wish to stream media, your Internet connection must be able to accommodate the bit rate of the media you wish to stream! For example: if you want to broadcast live streaming video at 300 kbit/s, then your Internet connection must be able to upload at a rate of 300 kbit/s

Streaming Media: Streaming media is digital media that is delivered to the end user via a *progressive download*: the media is viewed by the end-user as it is being saved to their hard disk. Typically, streaming media is automatically removed from the hard drive after it has been viewed.

Streaming media can be *live* or *on-demand*. In general, *live* media is conveyed from the source to the audience as it is being generated (rather like a live television broadcast); prospective audiences must know when the event is being held, and where to find it on the Internet, in order to tune in. *On-demand* streaming video is pre-recorded and downloaded by users when they wish to peruse it.

Appendix A.2: Media Vocabulary

Aspect Ratio: A ratio that describes the size of film, digital media, monitors, or projection screens in terms of the relationship between the X and Y axes of the media. For example: in the 1990s, most computer monitors had an aspect ratio of 4:3 pixels (or 1.333:1), meaning that for every 4 pixels wide, the monitor was 3 pixels tall. This yielded such common monitor and digital media resolutions as 640x480 pixels, 800x600 pixels, and 1024x768 pixels.

By comparison, the aspect ratio of High-Definition (HD) digital media and widescreen monitors is 16:9 pixels, or 1.77:1 pixels. This means that HD media are 16 pixels wide for every 9 pixels tall. Typical HD media and monitor resolutions are 640x360 pixels, 1024x576, 1280x720 pixels, and 1920x1080 pixels.

Bit Rate: see above.

Codec: Stands for “coder-decoder.” Codecs decompress digital audio and video as they are played, turning the stored media into a data stream suitable for playback. Many compression standards exist.

Compression: A method of reducing the hard disk storage used by a digital file. There exists an extensive variety of standards and profiles by which digital file compression can be achieved.

Digital media compression is divided into two types: *lossy* and *lossless*. *Lossy* compression permanently loses a degree of information when the file is compressed; *lossless* compression does not lose any information.

Digital audio and video are compressed according to standards that are designed to be compatible with specific *codecs*.

Frame rate: The rate at which moving images are displayed in succession to generate the illusion of motion. Frame rate is measured in *frames-per-second,* or FPS. Common frame rates include:

- 23.98 FPS: Standard frame rate for NTSC video; used in North America, Latin America, and parts of South America
- 24 FPS: Frame rate for Hollywood film
- 25 FPS: Standard frame rate for PAL color video; used in many European countries
- 29.97 FPS: Standard frame rate for NTSC color video
- 60 FPS: Frame rate for high-definition (HD) digital video (often, high-definition digital video is recorded at 59.94 FPS to make it directly compatible with NTSC video)

(Source: http://en.wikipedia.org/wiki/Frame_rate#_Digital_video_and_television)

Video frame rate determines the smoothness or choppiness of motion recorded by the camera. Low-frame rate video seems choppy; high-frame rate video seems smooth. Note that many audiences will be used to frame rates between 23.98 and 30 FPS.

Resolution: With regard to digital media and computer monitors, *resolution* is a measure of the pixels on the X and Y axes of the image. For example, a 640x480 monitor has 640 pixels on its X axis and 480 pixels on its Y axis. Digital images and video are measured the same way.

In general: the smaller the resolution, the smaller the digital media file. A digital media file that is both low-resolution and low-bitrate will provide a small image that lacks detail; a file that is high-resolution and high-bitrate will provide a large image that is very detailed.